

11 Programming – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
operators	运算符	_____
library routines	库例程	_____
concatenation	拼接	_____
nested	嵌套	_____

Recall

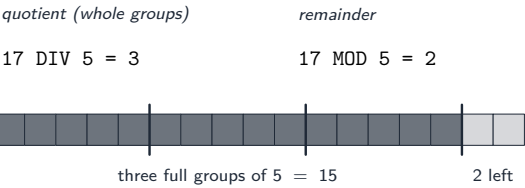
In **Part 1** you used variables and constants, the three constructs (selection, iteration), arrays, and subroutines (procedures, functions, parameters, scope). Part 2 adds two more operators and ready-made functions, the **CASE** statement, and writing clean, efficient code.

New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

1 Operators and library routines

Besides $+$ $-$ $\times$ $\div$, two useful **operators** 运算符 work on whole numbers: **DIV** (integer division — $7 \text{ DIV } 2 = 3$) and **MOD** (the remainder — $7 \text{ MOD } 2 = 1$).

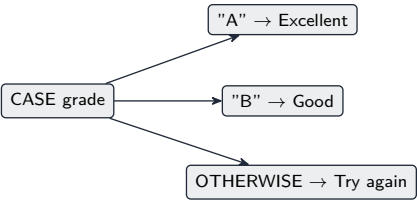


Many jobs already have ready-made **library routines** 库例程, so you don't write them yourself — string functions like `LENGTH(s)`, `LEFT(s, n)`, `MID(s, start, len)`, and joining two strings (**concatenation** 拼接) with `&`.

Worked example. $23 \text{ DIV } 10 = 2$ and $23 \text{ MOD } 10 = 3$, so 23 is "2 tens and 3 ones"; `LEFT("HELLO", 2)` gives "HE".

2 The CASE statement

To test one value against many options, a deep **nested** 嵌套 IF is hard to read; a **CASE** is cleaner:



```
CASE OF grade
  "A": OUTPUT "Excellent"
  "B": OUTPUT "Good"
  OTHERWISE: OUTPUT "Try again"
ENDCASE
```

Worked example. With `grade = "B"`, the CASE above matches the "B" branch and outputs "Good".

3 Writing efficient, readable code

- compute a value **once before a loop** if it doesn't change inside it;
- **exit a loop early** when the answer is found;
- use **meaningful names** (`numberOfPupils`, not `n`) and comment the *intent*, not the mechanics.

slower

```
FOR i = 1 TO n
  x = slow() // every pass
  use(x, i)
NEXT i
```

faster

```
x = slow() // once
FOR i = 1 TO n
  use(x, i)
NEXT i
```

Worked example. If a loop runs $\text{tax} \leftarrow \text{price} * 0.2$ every pass but **price** never changes inside it, move that line above the loop so it runs once, not a thousand times.

Watch out: DIV throws away the remainder — $7 \text{ DIV } 2$ is 3, not 3.5. Use MOD when you want the remainder.

Practice

11.1 Find (a) $17 \text{ DIV } 5$ and (b) $17 \text{ MOD } 5$. [2]

11.2 Find (a) $\text{LENGTH}(\text{"HELLO"})$ and (b) $\text{LEFT}(\text{"HELLO"}, 2)$. [2]

11.3 State when a CASE statement is a better choice than a nested IF. [1]

11.4 State the condition (using MOD) that is true when **n** is even. [1]

11.5 State one way to make a loop run more efficiently. [1]

11.6 Explain *why* $n \text{ MOD } 2 = 0$ is a correct test for whether **n** is even. [2]

11.7 Challenge. Using DIV and MOD, write pseudocode that inputs a number of seconds and outputs the whole minutes and the leftover seconds. [3]